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Publication date:
2016

Document Version
Peer reviewed version

[Link back to DTU Orbit](#)

Citation (APA):

Korenak, J., Zarebska, A., Buksek, H., Hélix-Nielsen, C., & Petrinic, I. (2016). *Flux behaviour under different operational conditions in osmosis process*. Abstract from Slovenian Chemical Days 2016, Slovenia.

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Flux behaviour under different operational conditions in osmosis process

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Abstract

The transport of water molecules across a semi-permeable membrane is driven by the osmotic pressure difference between feed and draw solution. Two different operational modes can be distinguished, namely FO mode when the active membrane layer is facing the wastewater (feed), and PRO mode when the active membrane layer is facing draw solution. Osmosis process can be affected by several factors, such as operating conditions (temperature and cross flow velocity), feed and draw solution properties, and membrane characteristics. These factors can significantly contribute to the efficiency of the process itself. In order to implement the osmosis process on an industrial scale, process economy need to be taken into consideration, as well as the desired final product quality. Membrane performance can be evaluated based on the water permeability and the selectivity of the membrane. The permeability coefficient (A) defined as the water flux through the membrane will be experimentally determined. Likewise selectivity of the membrane (B) will be measured, which will tell us about membrane retention properties of certain substances dissolved in feed solution. The aim of the study is to determine water flux and reverse salt flux through the semi-permeable membrane at FO and PRO modes using two types of membranes and using three different draw solutions (NaCl, MgCl₂, and CaCl₂). The process efficiency at different conditions will be assessed based on physical and chemical analysis such as pH, conductivity, and total dissolved solids. Taken together our results can contribute understanding of the how performance of asymmetric FO membranes can be enhanced by feed and draw properties, membrane characteristics and operational conditions.

Key words: forward osmosis, membrane characterisation, draw solutions, cross flow velocity.